CLAIMS

1. An optical element comprising:

a polarizing element (A), separating incident light into polarization to then emit light, and made of a cholesteric liquid crystal, wherein

the polarizing element (A) has a distortion rate with respect to emitting light to incident light in the normal direction of 0.5 or more and

a distortion rate with respect to emitting light to incident light at an angle inclined from the normal direction by 60 degrees or more of 0.2 or less,

the polarizing element (A) has a function increasing a linearly polarized light component of emitting light as incidence angle is larger;

a 1/2 wavelength plate (B);

a retardation layer (C) giving almost zero retardation to incident light in the front direction (normal direction) and giving a retardation to incident light in a direction inclined from the normal direction; and

a 1/4 wavelength plate (D); being arranged in this order,

and further a linearly polarized light reflection polarizer (E), transmitting linearly polarized light with one polarization axis and selectively reflecting linearly polarized light with the other polarization axis perpendicular to the one polarization axis, is arranged on the 1/4 wavelength plate (D) so that the transmission axis of the linearly polarized light reflection polarizer (E) and an axis of the transmitted light, which is transmitted through the polarizing element (A) to the 1/4 wavelength plate (D) in this order, are the same direction.

2. The optical element according to claim 1, wherein, in the polarizing element (A), the linearly polarized light component of emitting light increasing as incidence angle is larger has a polarization axis of linearly polarized light substantially perpendicular to the normal direction of a surface of the polarizing element.

3. The optical element according to claim 1, wherein, in the polarizing element (A), the linearly polarized light component of emitting light increasing as incidence angle is larger has a polarization axis of linearly polarized light substantially

parallel to the normal direction of a surface of the polarizing element.

4. The optical element according to any one of claims 1 to 3, wherein the polarizing element (A) substantially reflects a non-transmission component of incident light.

5. The optical element according to any one of claims 1 to 4, wherein a thickness of the polarizing element (A) is 2 μm or more.

6. The optical element according to any one of claims 1 to 5, wherein a reflection band width of the polarizing element (A) is 200 nm or more.

7. The optical element according to any one of claims 1 to 6, wherein the 1/2 wavelength plate (B) is a broad band wavelength plate working as an almost 1/2 wavelength plate over the entire visible light band.

8. The optical element according to claim 7, wherein the 1/2 wavelength plate (B) has a front retardation values, which is expressed by (nx – ny) x d, in the range of a 1/2 wavelength ± 10% at wavelengths in the light source wavelength band (ranging from 420 to 650 nm),

where a direction in which an in-plane refractive index is maximized is defined as X axis and a direction perpendicular to the X axis is defined as Y axis, where refractive indices in each axis directions are defined as nx and ny, respectively, and a thickness is defined as d (nm).

9. The optical element according to any one of claims 1 to 8, wherein the 1/2 wavelength plate (B) controls a retardation in the thickness direction and reduces a change in retardation caused by a change in angle.

10. The optical element according to claim 9, wherein the 1/2 wavelength plate (B) has an Nz coefficient, which is expressed by $Nz = (nx - nz)/(nx - ny)$, in a relation of $-2.5 < Nz \leq 1$,

where a direction in which an in-plane refractive index is maximized is defined as X axis, a direction perpendicular to the X axis is defined as Y axis and a thickness direction of the film is defined as Z axis, where refractive indices in each axis directions are defined as nx, ny and nz.

11 The optical element according to any one of Claims 1 to 10, wherein the

retardation layer (C) is at least one selected from the group consisting of:

a layer of a cholesteric liquid crystal phase having a selective reflection wavelength band in a range other than the visible light range and having a fixed planar alignment;

a layer of a rod-like liquid crystal having a fixed homeotropic alignment state;

a layer of a discotic liquid crystal having a fixed alignment state of a nematic phase or a columnar phase;

a layer of a biaxially-oriented polymer film;

a layer of a negative uniaxial inorganic layered compound having an optical axis aligned and fixed in the normal direction of a plane; and

a film produced with at least one polymer selected from the group consisting of polyamide, polyimide, polyester, poly(etherketone), poly(amide-imide), and poly(ester-imide).

12. The optical element according to any one of claims 1 to 11, wherein the 1/4 wavelength plate (D) is a broad band wavelength plate working as an almost 1/4 wavelength plate over the entire visible light band.

13. The optical element according to claim 12, wherein the 1/4 wavelength plate (D) has a front retardation values, which is expressed by $(nx - ny) \times d$, in the range of a 1/4 wavelength $\pm$ 10% at wavelengths in the light source wavelength band (ranging from 420 to 650 nm),

where a direction in which an in-plane refractive index is maximized is defined as X axis and a direction perpendicular to the X axis is defined as Y axis, where refractive indices in each axis directions are defined as nx and ny, respectively, and a thickness is defined as d (nm).

14. The optical element according to any one of claims 1 to 13, wherein the 1/4 wavelength plate (D) has an Nz coefficient, which is expressed by $Nz = (nx - nz)/(nx - ny)$, in a relation of $-2.5 < Nz \leq 1$,

where a direction in which an in-plane refractive index is maximized is defined as X axis, a direction perpendicular to the X axis is defined as Y axis and a thickness direction of the film is defined as Z axis, where refractive indices in each axis directions

are defined as nx, ny and nz.

15. The optical element according to any one of claims 1 to 14, wherein the linearly polarized light reflection polarizer (E) is a grid type polarizer.

16. The optical element according to any one of claims 1 to 14, wherein the linearly polarized light reflection polarizer (E) is a multilayer thin film laminate with two or more layers made of two or more kinds of materials having a difference between refractive indices.

17. The optical element according to claim 16, wherein the thin multilayer laminate is a vapor-deposited thin film.

18. The optical element according to any one of claims 1 to 14, wherein the linearly polarized light reflection polarizer (E) is a multi-birefringence layer thin film laminate with two or more layers made of two or more kinds of materials each having a birefringence.

19. The optical element according to claim 18, wherein the thin multilayer laminate is a stretched resin laminate with two or more layers containing two or more kinds of resins each having a birefringence.

20. The optical element according to any one of claims 1 to 19, wherein a polarizing plate is disposed outside of the linearly polarized light reflection polarizer (E) so that the polarized light transmission axis of the linearly polarized light reflection polarizer (E) and the polarization axis direction of the polarizing plate coincide with each other.

21. The optical element according to any one of claims 1 to 20, wherein layers are laminated with a transparent adhesive or pressure sensitive adhesive.

22. A light condensation backlight system, in which at least a light source is provided for the optical element according to any one of claims 1 to 21.

23. A liquid crystal display, in which at least a liquid crystal cell is provided for the light condensation backlight system according to claim 22.

24. The liquid crystal display according to claim 23, comprising a diffusing plate neither backscattering nor depolarizing laminated on the viewing side of the liquid crystal cell.